How to Evaluate and Manage Storm-Damaged Forest Areas

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METRIC EQUIVALENTS

1 inch. . . . . 2.54 centimeters
1 foot . . . . . 0.3048 meter (m)

HOW TO EVALUATE AND MANAGE STORM-DAMAGED FOREST AREAS

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INTRODUCTION

In the South, a natural disaster generally occurs every year or two. Hurricanes, tornadoes, and ice storms can cause extensive damage by uprooting, wounding, or permanently bending trees or breaking main stems, tops, or branches. Standing water can cause additional mortality. When a natural disaster occurs,it is important to have plans for removing damaged timber.

As soon as possible, the area should be identified by an aerial survey (sketch map or aerial photography). The next step is a ground check of the damage to determine the need for salvage operations. Priorities for salvage will depend on location, amount, and type of damage. The following information will assist in setting priorities.

MANAGING TO REDUCE PEST-CAUSED LOSSES

Pest infestations will not develop unless suitable host trees are available. During salvage operations, every effort should be made to increase stand resistance to future pest attack. To ensure that an effective and efficient salvage operation is conducted, the following approach is suggested:

1. Plan a salvage operation based on a thorough inspection of damage and merchantability. Prompt salvage will help avoid losses from degrade and subsequent pest-caused mortality.
2. Measure carefully the extent of the damage before deciding on a salvage operation. The stand probably should not be salvaged if the damaged volume is less than 3 to 5 cords per acre, since the damage to the residual stand would be greater than the benefits.
3. Salvage the most severely-damaged timber first. Concentrate on the pine stands, because they are more susceptible to pest damage than hardwood stands. During salvage operations, care should be taken not to damage the residual trees.
4. Complete salvage promptly, in one continuous operation. Bark beetle populations are more likely to build up in the slash and move into healthy trees if logging operations are prolonged or interrupted for periods of a month or more. (When salvage is delayed, a helpful guide is available for utilization of beetle-killed pine trees based on tree appearance. See table 1.)
5. Follow the practices listed below to ensure that the residual material (slash) will dry quickly. Bark beetle infestations will not build up in dry material.
   —Cut all logs from seriously damaged trees to the minimum size and remove them from the area.
   —Lop and scatter all slash and tops into open areas when possible.
   —Scatter large accumulations of slash away from the base of residual trees, and into direct sunlight if possible.
   —Sever downed timber from roots that could keep the trees alive and moist.
6. Inspect large timber for pitch flow. Many large, green, standing pines may be unusable for veneer, poles, or lumber because of internal splintering and separation of the wood fibers. Often, the only external evidence of such damage is pitch flow where the bark has been broken.
7. Follow the ratings in table 2 concerning species resistance to insects and diseases when planning the salvage of timber, especially hardwoods.
8. Consider deducting storm damage losses on income tax returns. Landowners can secure advice from local foresters, accountants, attorneys, or Internal Revenue Service agents concerning deductible losses.
9. Check for pest activity after salvage operations are finished. Make periodic surveys, either aerial or ground, of the residual stands to check for pest activity. Trees that are turning yellow, have pitch tubes on the bark, or red boring dust around the base, are probably affected by insects, diseases, or both.

Table 1 — Utilization guidelines for beetle-killed pine trees.[1]

Product	Class A Trees with needles or no needles, but twigs attached	Class B Trees with no needles, most twigs and branches lost, and some broken tops	Comments
Lumber—appearance[2]	Not recommended	Not recommended	Blue-stain prohibits use.
Lumber—dimension[2]	Can be used with caution	Not recommended	Should be kiln dried to prevent emergence of secondary insects. Low moisture content may dull saws and chipper knives faster than with with sound wood and may require milder kiln schedule. Do not use where toughness is important.
Lumber—decorative boards and paneling	Can be used	Can be used	Should be kiln dried.
Posts, poles, piling	Not recommended	Not recommended	Toughness and preservative treatability may be highly variable.
Plywood	Can be used	Not recommended	Adhesives and gluing practices may have to be adjusted.
Hardboard, particleboard, medium-density fiberboard	Can be used	Can be used	Low moisture content may affect some production schedules. Should be mixed with sound wood.
Pulp	Can be used	Can be used	Blue-stain and low moisture content may affect pulping process and chemical or energy requirements. Should be mixed with sound wood, particularly where strength is important.
Fuelwood	Can be used	Can be used	Low moisture content increases heat value.

[1] For more information on utilization of beetle-killed trees, see *A Guide for Using Beetle-Killed Southern Pine Based on Tree Appearance,* by Michael P. Levi, USDA Agriculture Handbook No. 572.

[2] For more information on economics of producing lumber from beetle-killed pines, see *A Mill Operator's Guide to Profit on Beetle-Killed Southern Pine,* by S. A. Sinclair, USDA Agriculture Handbook No. 555.

Table 2 — **Resistance of tree species to hurricane-related damage (in descending order of resistance).**

Breakage	Uprooting	Salt	Deterioration by Insect and Disease
live oak	live oak	live oak	live oak
palm	palm	palm	palm
baldcypress	baldcypress	slash pine	sweetgum
pondcypress	pondcypress	longleaf pine	water oak
sweetgum	tupelo gum	pondcypress	sycamore
tupelo gum	red cedar	loblolly pine	baldcypress
mimosa	sweetgum	red cedar	pondcypress
dogwood	sycamore	tupelo gum	southern red oak
magnolia	longleaf pine	baldcypress	magnolia
sweet bay	mimosa	sweetgum	tupelo gum
southern red oak	southern red oak	water oak	sweet bay
water oak	magnolia	sycamore	hickory
sycamore	slash pine	sweet bay	pecan
longleaf pine	loblolly pine	southern red oak	red cedar
slash pine	sweet bay	hickory	red maple
loblolly pine	water oak	mimosa	mimosa
red cedar	red maple	pecan	dogwood
hickory	dogwood	magnolia	longleaf pine
red maple	hickory	red maple	slash pine
pecan	pecan	dogwood	loblolly pine

UPROOTED TREES

If not salvaged promptly, uprooted trees will probably be degraded by stains, decays, and secondary insects, such as Ips bark beetles, borers, powder post beetles, and ambrosia beetles. The longer salvage is delayed, the greater the amount of degrade and weight loss from rapid drying. This often results in a stumpage value loss to the salvage operator. The amount of degrade that is acceptable to industry depends on the species and local markets. The following table gives the sequence of invading organisms:

	Time	
Species	**Year 1**	**Year 2**
Pine	Bark beetles, ambrosia beetles, sawyers, blue stain fungi, soft rot fungi	Decay fungi
Oak-Hickory	Wood borers, ambrosia beetles, stains, soft rot fungi	Sapwood decay fungi
Other Hard-woods	Wood borers, ambrosia beetles, stains, soft rot fungi	Sap and heartwood decay fungi

ROOT SPRUNG (LEANING) TREES

Root sprung trees will not die immediately, but will show decline symptoms over a period of several years. These trees may be invaded by root rot organisms, and subjected to drought stress and insect attack. Root sprung pines may be invaded by bark beetles and blue stain fungi. These pines can serve as prime habitat for the southern pine beetle and, if conditions become favorable, an outbreak could occur. They can also harbor high populations of turpentine beetles.

Special Management Considerations

Hardwood trees with major root damage should be salvaged as soon as possible to avoid a value loss from degrade.

MAIN STEM BREAKAGE

Trees with main stem breakage will be invaded by a variety of insects and disease-causing organisms. Hardwoods may not die, but will be severely degraded by stain and decay fungi. Pines often will be infested and killed by bark beetles and infected with blue stain fungi. They can support high southern pine beetle populations immediately after breakage, but soon become unsuitable hosts, due to rapid deterioration. Turpentine and Ips bark beetles also commonly attack pines and can build to damaging populations.

BROKEN TOPS OR BRANCHES

Trees with broken branches that have exposed heartwood will be infected by stain and decay fungi at the point of injury. Stains will move vertically from the point of injury at a rate of 6 to 18 inches per year, depending on the tree species and decay organisms. Decay fungi will follow the stain fungi in about 8 to 10 months. Breaks smaller than 3 inches in diameter, with no heartwood exposed, may be infected by sapwood decay fungi with no serious economic losses. Some broken branches in the tops of the pine species may be attacked by bark beetles and infected with blue stain fungi.

Special Management Considerations

Trees with broken terminals and major limb damage (breaks 3 inches or larger) should be removed during the next scheduled harvest. High value trees, such as those in yards, recreation areas, and seed orchards, should be properly pruned to promote rapid healing.

MAJOR WOUNDS

Many trees sustain wounds caused by falling tops, adjacent uprooted trees, and major branch breakage. In hardwoods, wounds that do not penetrate more than 2 inches into the sapwood and have less than 144 square inches of surface area will have only localized stain, but no decay. Wounds that exceed these limits will have stains and decay that move at the rates described for broken branches. Pine trees with major wounds to the lower bole and larger roots may be attacked by bark beetles.

Special Management Considerations

These trees should be removed during the next scheduled harvest.

BENT TREES

Bent hardwoods usually are not attacked by insects or diseases because they are not in a stressed condition. Pine trees that are bent to the extent that cracks and resin flow occur may be invaded by bark beetles and disease- causing organisms.

Special Management Considerations

Severely bent hardwoods should be salvaged during the next scheduled harvest. Be sure to inspect large pine timber for pitch flow. Many large, green, standing pines may not be usable for veneer, poles, or lumber because of internal ring shake, splintering, and separation of the wood fibers. Often, the only external evidence of such damage is pitch flow where the injury has broken the bark. These characteristics are often overlooked, and considerable losses are incurred during a later harvest.

TREES KILLED OR WEAKENED BY STANDING WATER

Trees killed or weakened by standing water are often attacked by insects or infected by diseases.

Special Management Considerations

Favor flood tolerant trees and shrubs in areas subject to intermittent flooding.

Flood tolerant trees that can be planted or maintained on intermittently flooded areas include: green ash, sycamore, cottonwood, willow, sweetgum, American elm, pecan, mulberry, silver maple, red maple, baldcypress, river birch, and persimmon.

Flood tolerant shrubs include: buttonbush, sand plum, deciduous holly, and swamp ironwood.

LIGHTNING-DAMAGED TREES

Trees injured by lightning are often killed immediately. Hardwood trees that are damaged, but not killed, may be attacked by insects and disease-causing organisms. Lightning-damaged pine trees are preferred hosts of bark beetles, particularly the southern pine beetle, and can increase these populations. Stain fungi subsequently follow beetle attack.

Special Management Considerations

Severely damaged and dead hardwoods should be salvaged during the next scheduled harvest. When economical, lightning-struck pines should be cut within 30 days to prevent bark beetle buildup.

HAIL-DAMAGED TREES

Hail can remove foliage and cause mechanical damage to stems that do not have enough bark to cushion the impact. In most cases, the damage is not serious enough to affect management. However, in more severe cases, branch dieback can become a serious problem. Fungi, such as pitch canker, and insects, such as Ips bark beetles, may invade the affected areas and increase the damage.

Special Management Considerations

Severely damaged stands need to be monitored closely for at least one year. Older stands normally recover with no problem, but younger stands may sustain enough loss to affect stand management.

MANAGING TO REDUCE HURRICANE DAMAGE

A tree's ability to withstand hurricane winds and salt damage varies with the species. Wind resistance depends on the interaction of five factors: strength of the wood, shape and size of the crown, extent and depth of the root system, previous moisture conditions, and shape of the bole.

No tree species has perfect wind resistance, but live oak, palm, pond-cypress, and baldcypress are among the best, as shown in table 2. These trees combine deep, well-established lateral and tap roots with buttressed trunks (low center of gravity). The wood of live oak is exceedingly strong and resilient. The crown is usually widespread, but this doesn't seen to negate its strong points. Cypress has relatively weak wood, but its crown is so sparse and its foliage so limber that it is also extremely wind-firm.

Shallow-rooted trees are easily uprooted, especially after the soil is saturated by heavy rains. Common shallow-rooted trees along the coast are dogwood, water oak, pecan, bay, and red maple. Common deep-rooted trees are live oak, longleaf pine, and pond and baldcypress.

Trees growing in sandy soils are more deeply rooted than trees growing in clay or soils with an inhibiting clay layer or a high water table. Although rooting habits vary according to the soil profile, each species has a characteristic pattern. Another factor to be considered is the height of the tree. The taller the tree, the greater is its chance of breaking, especially if the bole has little taper. For this reason, the tall, slim slash and longleaf pines are extremely vulnerable.

Open-crowned and lacy foliaged trees, such as cypress and mimosa, offer less resistance to the wind, and thus are better able to survive. On the other hand, magnolia trees with their heavy, wind-catching foliage are windthrown more than their root system and bole structure would indicate. Palm trees offer little surface to the wind because they have almost no laterally extended crown and branches. This characteristic makes them a fairly wind-free tree, despite their close and small root structure.

Based on these observations, the following preventive measures are recommended to forest managers in hurricane-risk areas:

1. Keep a balanced mixture of size classes to prevent a complete loss. Young trees are rarely damaged, because they tend to bend with the wind; old trees tend to break.
2. Where feasible, stagger thinnings to limit exposure of the recently thinned areas. (During Hurricane Camille, it was found that recently thinned stands of pine with little taper were severely broken, while open stands and stands thinned several years earlier suffered less damage.)
3. Manage for well-spaced, thrifty trees and, as much as possible, develop a spread of age classes to distribute the risk of wind damage.
4. Plant longleaf pine when deep sandy soils are present, because longleaf has a deep tap root system.
5. When planting slash and loblolly, use 8 x 8 foot spacing or wider.

Winds often carry salt water inland for a considerable distance. The leaves on trees saturated with salt water turn brown and give the ap-

pearance of being burned. Most of these trees will not die and should not be cut. See table 2 for individual tree resistance. The trees will lose their leaves and some growth, but most of them will grow new leaves in the spring and will recover. Check salt-damaged trees closely the following spring for adequate recovery or possible bark beetle attack. Trees should be harvested if they have not put on new growth or have been attacked by bark beetles.